

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2000-203047

(43)Date of publication of application : 25.07.2000

(51)Int.Cl.

B41J 2/175

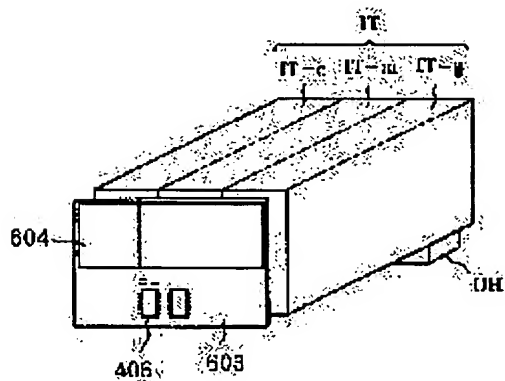
(21)Application number : 11-004579

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(22)Date of filing : 11.01.1999

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(54) RECORDER



(57)Abstract:

PROBLEM TO BE SOLVED: To detect running out of ink easily with high reliability by inputting a pulse signal to the first electrode of a recording head, providing a second electrode contiguous to the wall face of an ink tank with a signal detecting means comprising an input signal amplifying means and arranging the second electrode and the amplifying means on a same board.

SOLUTION: A pulse signal inputted from the head part electrode of a recording head IJH is transmitted through a conductive medium to the wall face of an ink tank thence transmitted through capacitive coupling to an antenna electrode disposed contiguously to the wall face of the ink tank. The antenna electrode and a circuit board 603 are secured by means of screws and connected electrically at a contact part in order to transmit a signal from the antenna electrode to an OP amplifier 406 through the board. Signal of the OP amplifier 406 is sampled and held and a signal subjected to A/D conversion is compared with a decision criterion stored

in an ROM thus detecting run out of ink. A pattern 604 for antenna electrode and the OP amplifier 406 are mounted on the surface where the wall face of the ink tanks IT-c, m, y are exposed entirely.

LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision  
of rejection]

[Date of requesting appeal against examiner's  
decision of rejection]

[Date of extinction of right]

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**CLAIMS**

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[Claim(s)]

[Claim 1] The recording head which is the recording device which records an image by carrying out the regurgitation of the liquid ink drop to a record medium, and prepared the 1st electrode, An ink tank and the 2nd electrode which adjoins the wall surface of said ink tank and is prepared, An input means to input the pulse signal of a predetermined frequency into said 1st electrode, The recording device characterized by having a magnification means to amplify the signal received with said 2nd electrode, and a detection means to detect the ink piece of said ink tank based on the signal amplified by said magnification means, and mounting said the 2nd electrode and said magnification means on the same substrate.

[Claim 2] The recording device according to claim 1 characterized by making said substrate adjoin the wall surface of said ink tank so that said magnification means may be mounted in the 1st layer of said substrate, said 2nd electrode may be mounted in the 2nd layer of said substrate as a pattern and said 2nd layer may become near by the wall surface of said ink tank.

[Claim 3] The recording device according to claim 2 characterized by preparing further the shielding layer grounded as the 3rd layer between said 1st layer and said 2nd layer.

[Claim 4] Said ink tank is a recording device according to claim 1 characterized by including the 1st tank which holds cyanogen ink, the 2nd tank which holds Magenta ink, and the 3rd tank which holds Hierro ink.

[Claim 5] Said recording head is a recording device according to claim 4 characterized by having the 1st, the 2nd, and the 3rd head unit, and preparing said 1st electrode in the said 1st, 2nd, and 3rd head unit of each so that the regurgitation of said cyanogen ink, Magenta ink, and Hierro ink may be carried out.

[Claim 6] Said recording head is a recording device according to claim 1 characterized by being

the ink jet recording head which records by breathing out ink.

[Claim 7] Said recording head is a recording device according to claim 6 characterized by having the electric thermal-conversion object for generating the heat energy given to ink in order to carry out the regurgitation of the ink using heat energy.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] Especially this invention relates to the recording device equipped with the recording head which records the information on an alphabetic character, an image, etc. by carrying out the regurgitation of the ink on a record medium about a recording device.

[0002]

[Description of the Prior Art] The recording device by the ink jet method has spread quickly as one of the output (record) equipment of those devices with the spread of information management systems, such as a reproducing unit in recent years, and a word processor, a computer.

[0003] Generally the ink jet recording device is equipped with the control means for controlling the carriage carrying the recording head and ink tank which carry out the regurgitation of the liquid ink drop, a conveyance means to convey a record medium, and these.

[0004] Now, in such an ink jet recording device, a liquid ink drop is not breathed out from a recording head with the ink piece of the ink tank in the middle of record actuation, but poor record may arise. For example, if an ink piece arises while recording many, feeding paper to a record form continuously, the chart lasting time after an ink piece will become useless.

Moreover, when the record indistinct in the state of the so-called "blur record" produced by the ability not carrying out the regurgitation of the liquid ink drop appropriately also just before an ink piece is continued, many record media may be made useless.

[0005] In order to avoid such fault, the ink piece detection approaches various until now are proposed. For example, the method of performing ink piece detection is proposed by inputting a known pulse signal into a recording head, and detecting the input pulse signal with the antenna electrode which adjoined the ink tank wall surface. Henceforth, this approach is called the "pulse transfer ink piece detection approach."

[0006] Hereafter, with reference to drawing 9 and drawing 10, the principle of the pulse transfer ink piece detection approach is explained. In these drawings, the case where it is a time of drawing 10 not having ink in an ink tank in the case where it is a time of drawing 9 having ink in an ink tank is shown.

[0007] The electrode 102 which touches ink is formed in the interior of a recording head 101, and as shown in these drawings, in order to detect an ink piece, on the other hand, it connects in the ink passage 106 for a recording head 101 to supply ink, and the antenna electrode 107 is formed so that the wall surface of the ink tank 103 which held the sponge 104 for holding ink may be adjoined.

[0008] Moreover, as shown in drawing 9, when ink is in the ink tank 103, ink will fully be sunk in at sponge 104. On the other hand, as shown in drawing 10, when there is no ink in the ink tank 103, sponge 104 will not be in the condition of having been filled with ink any longer, but the space 111 without ink will come to produce it in the ink passage 106.

[0009] Now, in order to detect an ink piece, the known input pulse 105 is inputted into an electrode 102. This input pulse is spread on the ink tank 103 by using the ink in the ink passage

106 as an electric conduction medium. It is detected by the antenna electrode 107 which adjoined the ink tank wall surface, the sample of the peak (maximal value) and bottom (minimal value) of an output signal from an op amplifier 108 is carried out after magnification by the op amplifier 108 (AMP) in a sample hold circuit (S/H) 109, and the pulse which got across to the ink tank is inputted into the A/D port of CPU110. By CPU110, the amplitude of a signal is computed from this input signal, and the signal amplitude obtained as a result is compared with a predetermined criterion (threshold).

[0010] When ink is in the ink tank 103, as shown in drawing 9, the amplitude (p-p) of the output signal 112 from an op amplifier 108 is large, and the signal amplitude computed by CPU207 has a value beyond a criterion. Therefore, CPU110 is judged to be ink piece nothing, i.e., those with ink.

[0011] On the other hand, when there is no ink in an ink tank, the pulse signal 105 inputted into the electrode 102 is intercepted in the space 111 in the ink passage 106, and does not reach even to the ink tank 103. Consequently, a pulse signal is not detected from the antenna electrode 107 contiguous to the ink tank 103, but the amplitude (p-p) of the output signal 113 from an op amplifier 108 becomes very small. Therefore, the value of the signal amplitude computed by CPU207 is also very small, becomes below a criterion, and is judged as CPU207 having no ink piece, i.e., ink.

[0012]

[Problem(s) to be Solved by the Invention] However, in the above-mentioned conventional example, since the detail part by a sheet metal etc. was used for the antenna electrode, components mark increased as the whole equipment and there were troubles, like parts control and assembly nature are bad.

[0013] In addition, since it was carrying out by making connection of an electrical circuit to an antenna electrode for the screw stop of an antenna electrode and the circuit board conventionally, there was a problem of causing the fall of the dependability by the slack of a screw etc. Moreover, in the above-mentioned configuration, an antenna electrode, an electrical circuit required for ink piece detection, and the physical distance of a between became long, the S/N ratio got worse by mixing of an external noise, and there was a problem that malfunction of equipment occurred.

[0014] The ink piece detection which was made in view of the above-mentioned conventional example, and had high dependability is possible for this invention, and it is in offering the recording device which can incorporate a component required for the detection easily.

[0015]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, the recording device of this invention consists of the following configurations.

[0016] Namely, the recording head which is the recording device which records an image by carrying out the regurgitation of the liquid ink drop to a record medium, and prepared the 1st electrode, An ink tank and the 2nd electrode which adjoins the wall surface of said ink tank and is prepared, An input means to input the pulse signal of a predetermined frequency into said 1st electrode, It is based on the signal amplified by magnification means to amplify the signal received with said 2nd electrode, and said magnification means. It has a detection means to detect the ink piece of said ink tank, and has the recording device characterized by mounting said the 2nd electrode and said magnification means on the same substrate.

[0017] A magnification means is mounted in the 1st layer of said substrate, the 2nd electrode is mounted in the 2nd layer of the substrate as a pattern, and you may make it make the substrate adjoin the wall surface of an ink tank here so that the 2nd layer may become near by the wall surface of an ink tank.

[0018] Furthermore, you may make it prepare the shielding layer grounded as the 3rd layer between the 1st layer and the 2nd layer.

[0019] Moreover, you may make it said ink tank contain the 1st tank which holds cyanogen ink, the 2nd tank which holds Magenta ink, and the 3rd tank which holds Hierro ink. In this case, as for a recording head, it is desirable to have the 1st, the 2nd, and the 3rd head unit, and to prepare the 1st electrode in the 1st, 2nd, and 3rd head unit of each so that the regurgitation of cyanogen ink, Magenta ink, and the Hierro ink may be carried out.

[0020] Although it is the ink jet recording head which records by this recording head breathing out ink, in order to carry out the regurgitation of the ink using heat energy, as for that recording head, it is desirable to have the electric thermal-conversion object for generating the heat energy given to ink.

[0021]

[Embodiment of the Invention] With reference to an accompanying drawing, the suitable operation gestalt of this invention is explained to a detail below.

[0022] <Approximate account of body of equipment> drawing 1 is the appearance perspective view showing the outline of the configuration of the ink jet printer IJRA which is the gestalt of typical operation of this invention. In drawing 1, the carriage HC engaged to the spiral slot 5004 of a leading screw 5005 which is interlocked with the forward inverse rotation of a drive motor 5013, and is rotated through the driving force transfer gears 5009-5011 has a pin (un-illustrating), is supported by the guide rail 5003, and carries out both-way migration of an arrow head a and the direction of b. The recording head IJH and the one apparatus ink jet cartridge IJC which built in the ink tank IT are carried in Carriage HC. 5002 is a paper bail plate and presses the record form P to a platen 5000 covering the migration direction of Carriage HC. 5007 and 5008 are photo couplers and are a home-position detector for checking existence [ in this region of the lever 5006 of carriage ], and performing a hand-of-cut switch of a motor 5013 etc. 5016 is the member which supports the cap member 5022 which caps the front face of a recording head IJH, and 5015 is the aspirator which attracts the inside of this cap, and performs suction recovery of a recording head through the opening 5023 in a cap. 5017 is a cleaning blade, 5019 is a member which makes this blade movable at a cross direction, and these are supported by the body support plate 5018. It cannot be overemphasized that not this gestalt but a well-known cleaning blade can apply a blade to this example. Moreover, 5021 is a lever for starting suction of suction recovery, it moves with migration of the cam 5020 which engages with carriage, and migration control is carried out by the transfer devices in which the driving force from a drive motor is well-known, such as a clutch switch.

[0023] When carriage comes to the field by the side of a home position, it is constituted so that a request can be processed according to an operation of a leading screw 5005 in those correspondence locations, but if it is made to operate to well-known timing about a request, each can apply these capping, cleaning, and suction recovery to this example.

[0024] The control configuration for performing <explanation of a control configuration>, next record control of equipment mentioned above is explained.

[0025] Drawing 2 is the block diagram showing the configuration of the control circuit of an ink jet printer IJRA. In this drawing showing a control circuit, ROM which stores the control program with which MPU performs the interface into which 1700 inputs a record signal, and 1701, and MPU1701 performs 1702, and 1703 are DRAMs which save various data (record data supplied to the above-mentioned record signal or a head). 1704 is a gate array (G. A.) which performs supply control of the record data to a recording head 1708, and also performs data transfer control between an interface 1700, and MPU1701 and RAM1703. A carrier motor for 1710 to convey a recording head 1708 and 1709 are the conveyance motors for recording paper

conveyance. The head driver to which 1705 drives a recording head, and 1706 and 1707 are Motor Driver for driving the conveyance motor 1709 and the carrier motor 1710, respectively.

[0026] If actuation of the above-mentioned control configuration is explained, and a record signal goes into an interface 1700, a record signal will be changed into the record data for a print between a gate array 1704 and MPU1701. And while Motor Driver 1706 and 1707 drives, a recording head drives according to the record data sent to the head driver 1705, and record is performed.

[0027] In addition, the ink jet cartridge IJC in this operation gestalt shall carry two or more ink tanks for color record.

[0028] Next, the ink piece detection according to this operation gestalt is explained. Here, in order to explain the description and effectiveness of this operation gestalt more clearly, it explains as compared with the configuration and its processing of the circuit used for the conventional ink piece detection.

[0029] First, conventional circuitry and its processing are explained.

[0030] Drawing 3 is drawing showing the structure of the ink jet cartridge IJC, the configurations of the conventional antenna electrode, and such physical relationship.

[0031] It consists of recording heads IJH equipped with three head units which offered the ink delivery which corresponded in order to carry out the regurgitation of the ink of each color supplied from ink tank IT-c in which the ink jet cartridge IJC holds cyanogen (C) ink as shown in drawing 3, ink tank IT-m which holds Magenta (M) ink, ink tank IT-y which holds Hierro (Y) ink, and these ink tanks. Moreover, the electrode (un-illustrating) is prepared in the recording head IJH so that the electrical and electric equipment may get across to each ink tank through the ink of ink passage (un-illustrating). On the other hand, to the field where all of the wall surface of these ink tanks have appeared, as shown in drawing 3, the antenna electrode 402 is arranged. And the stop of the circuit board 405 which mounted the op amplifier (AMP) 406 so that the antenna electrode 402 might be countered is \*\*\*\*\*ed and carried out to the metal plate which constitutes the antenna electrode 402 with a screw 409.

[0032] Now, in order to detect the ink piece in these ink tank, the pulse signal will use ink as an electric conduction medium, and MPU1701 will be transmitted even to an ink tank, if the pulse signal of a predetermined frequency is inputted into a recording head IJH as a record signal through the above-mentioned electrode. The signal with which even the ink tank reached is transmitted from an ink tank wall surface to the antenna electrode 402.

[0033] Drawing 4 is drawing showing the configuration of the equalizing circuit of the circuit relevant to ink piece detection, and the conventional ink piece detector among configurations of being shown in drawing 3.

[0034] That is, the pulse signal of a predetermined frequency is inputted one by one, changing a switch 413 to three head section electrode 401 each prepared corresponding to three ink tanks. Thus, the pulse signal 407 inputted from the head section electrode 401 prepared in the recording head IJH is transmitted to the ink tank wall surface 404 by using ink 403 as an electric conduction medium. The signal transmitted to the ink tank wall surface 404 is transmitted to the antenna electrode 402 which adjoins an ink tank wall surface by a kind of capacity coupling.

[0035] As shown in drawing 3, it is fixed with a screw 409, and the antenna electrode 402 and the circuit board 405 are electrically connected in the contact section, as shown in drawing 4. Therefore, the signal from the antenna electrode 402 is inputted and amplified by the substrate 405 from the contact section at propagation and an op amplifier (AMP) 406. And as the conventional example also explained, sample hold of the signal 408 outputted from the op amplifier (AMP) 406 is carried out, and further, A/D conversion of it is carried out, it turns into a digital signal, and is inputted into MPU1701. And this digital signal is compared with the

criterion (threshold) stored in ROM1702, and the existence of an ink piece is detected.

[0036] In addition, it connects with the circuit board in the place which left the output from an antenna electrode with wiring, without carrying out the screw stop of the antenna electrode 402 and the circuit board 405 conventionally, and there are some which were constituted so that it might input into the op amplifier (AMP) mounted on the circuit board.

[0037] Next, the circuit board for the antenna electrode according to this operation gestalt and ink piece detection is explained.

[0038] Drawing 5 is drawing showing the structure of the ink jet cartridge IJC, the configurations of the antenna electrode according to this operation gestalt, and such physical relationship. In addition, in drawing 5, the reference number same about the same component as having already explained in drawing 3 is attached, and the explanation is omitted.

[0039] As shown in drawing 5, the circuit board 603 is arranged to ink tank IT-c, IT-m, and the field where all the wall surfaces of IT-y have appeared. And on the circuit board 603, the pattern 604 and op amplifier (AMP) 406 for antenna electrodes are mounted.

[0040] Drawing 6 is drawing showing the configuration of the equalizing circuit of the circuit relevant to ink piece detection, and the conventional ink piece detector among configurations of being shown in drawing 5. In addition, in drawing 6, the reference number same about the same component as having already explained in drawing 4 is attached, and the explanation is omitted.

[0041] That is, the pulse signal of a predetermined frequency is inputted one by one, changing a switch 413 to three head section electrode 401 each prepared corresponding to three ink tanks. Thus, the pulse signal 407 inputted from the head section electrode 401 is transmitted to the pattern 604 for antenna electrodes prepared on the circuit board 603 which adjoins an ink tank wall surface as mentioned above by a kind of capacity coupling. Thus, the signal which got across to the pattern 604 for antenna electrodes is inputted into the op amplifier (AMP) 406 similarly mounted in the circuit board 603. And as the conventional example also explained, sample hold of the output signal 408 amplified by the op amplifier (AMP) 107 is carried out, and further, A/D conversion of it is carried out, it turns into a digital signal, and is inputted into MPU1701. And this digital signal is compared with the criterion (threshold) stored in ROM1702, and the existence of an ink piece is detected.

[0042] Here, the ink piece detection processing performed based on the above configuration is explained with reference to the flow chart shown in drawing 7. With this operation gestalt, when an ink jet printer IJRA goes into a recording mode, existence of an ink piece is checked.

[0043] That is, at step S110, if it becomes a recording mode, as mentioned above, the pulse 407 of a predetermined frequency will be inputted into the electrode 401 prepared in the recording head IJH, and the detecting signal from the antenna electrode 604 will be acquired. At step S120, it investigates whether the ink piece is generated based on the detecting signal.

[0044] Here, when it is judged that the ink piece is generated (with no ink), processing progresses to step S130 and performs suction recovery action. in addition, since there is no ink piece detection by pulse transfer by the approach of detecting the ink residue in an ink tank, at step S140, there is no ink into an ink tank by this suction recovery action -- or it checks again by inputting a pulse into the electrode of a recording head for whether ink only went out to ink passage, and acquiring the detecting signal from an antenna electrode. If ink only went out to ink passage, by suction recovery action, cutting of ink passage is recovered and it should be judged with there being no ink piece.

[0045] Here, when again judged as an ink piece, processing progresses to step S150, makes the ink exchange lamp formed in the control panel (un-illustrating) of an ink jet printer IJRA turn on, and demands ink tank exchange from a user. Furthermore, the ink tank exchange by the user is checked at step S160. That is, in step S160, if exchange of an ink tank is not checked, processing

returns to step S150, lighting of an ink exchange lamp is continued and exchange of an ink tank is checked, processing will return to step S110 and will perform ink piece detection again.

[0046] Moreover, in step S140, if generating of an ink piece is not checked, processing progresses to step S170 and starts record actuation.

[0047] Also in step S120, if generating of an ink piece is not checked, processing progresses to step S170 and starts record actuation further again.

[0048] In the pulse transfer ink piece detection explained above, the signal outputted from the antenna electrode 604 is a very minute signal. For this reason, the S/N ratio of a signal gets worse extremely by noise mixing from the outside, and malfunction may be caused.

[0049] However, with the operation gestalt explained above, since the antenna electrode and the op amplifier (AMP) are mounted on the same substrate, it is possible to shorten physical distance between an antenna electrode and an op amplifier (AMP), and extreme aggravation of the S/N ratio by noise mixing from the outside can be prevented. Moreover, since it is not necessary to connect with wiring the circuit board which mounted the antenna electrode and the op amplifier like before since the antenna electrode was on the circuit board, it is also possible to prevent the trouble by poor contact, and it becomes possible to secure high dependability to ink piece detection.

[0050] Furthermore, the components mark of the whole equipment lead also to reduction, and that such a connection is lost or mounting an antenna electrode and an op amplifier (AMP) on the same substrate contribute also to improvement in the assembly nature at the time of equipment manufacture.

[0051] Although the above-mentioned operation gestalt explained the example which prepared the op amplifier (AMP) and the pattern for antenna electrodes on the same side of the circuit board which adjoined the ink tank, as shown in drawing 8, the structure of the circuit board 603 may be the multilayer substrate which consists of a components layer (field) 801 which mounts an op amplifier 406, and an antenna electrode layer 802 which prepared the pattern for antenna electrodes. And as for a patterned layer, it is desirable to make it become a field nearest to an ink tank. Thus, in the constituted circuit board, the signal received by the pattern for antenna electrodes prepared in the antenna electrode layer 802 is inputted into the op amplifier (AMP) 406 mounted by the components layer 801 on propagation and the components layer 801 from the antenna electrode layer 802 by the through hole.

[0052] This input signal is processed as mentioned above, and the existence of an ink piece is detected.

[0053] In addition, the circuit board may be made into the multilayer structure of three or more layers, and you may make it the configuration which has a components layer (field), an antenna electrode layer, and a shielding layer. In this case, the layer nearest to an ink tank arranges the pattern grounded by the layer which adjoins an antenna electrode layer and this antenna electrode layer, makes this a shielding layer, and uses the remaining layers as a components layer. By making it such a configuration, the electric noise and external noise which are generated from the electrical part mounted on the components layer (field) can prevent aggravation of the S/N ratio of the detection signal received by the antenna electrode with propagation and an antenna electrode.

[0054] In addition, in the above operation gestalt, although it was explained that the drop breathed out from a recording head was ink, and it was explained that the liquid further held in an ink tank was ink, the hold object is not limited to ink. For example, in order to raise fixable and the water resisting property of a record image or to raise the image quality, a thing like the processing liquid breathed out to a record medium may be held in the ink tank.

[0055] Especially the above operation gestalt is equipped with means (for example, an electric



thermal-conversion object, a laser beam, etc.) to generate heat energy as energy used also in an ink jet recording method in order to make the ink regurgitation perform, and can attain the densification of record, and highly minute-ization by using the method which makes the change of state of ink occur with said heat energy.

[0056] About the typical configuration and typical principle, what is performed using the fundamental principle currently indicated by the U.S. Pat. No. 4723129 specification and the 4740796 specification, for example is desirable. Although this method is applicable to both the so-called mold on demand and a continuous system On the electric thermal-conversion object which is especially arranged corresponding to the sheet and liquid route where the liquid (ink) is held in the case of the mold on demand By impressing at least one driving signal which gives the rapid temperature rise which supports recording information and exceeds film boiling Since make an electric thermal-conversion object generate heat energy, the heat operating surface of a recording head is made to produce film boiling and the air bubbles in the liquid (ink) corresponding to this driving signal can be formed by 1 to 1 as a result, it is effective. A liquid (ink) is made to breathe out through opening for regurgitation by growth of these air bubbles, and contraction, and at least one drop is formed. If the shape of a pulse form is carried out, since growth contraction of air bubbles will be appropriately performed instantly in this driving signal, the regurgitation of a liquid (ink) excellent in especially responsibility can be attained, and it is more desirable.

[0057] As a driving signal of the shape of this pulse form, what is indicated by the U.S. Pat. No. 4463359 specification and the 4345262 specification is suitable. In addition, if the conditions indicated by the U.S. Pat. No. 4313124 specification of invention about the rate of a temperature rise of the above-mentioned heat operating surface are adopted, further excellent record can be performed.

[0058] The configuration using the U.S. Pat. No. 4558333 specification and U.S. Pat. No. 4459600 specification which indicate the configuration arranged to the field to which a delivery which is indicated by each above-mentioned specification, a liquid route, and the heat operating surface other than the combination configuration (a straight-line-like liquid flow channel or right-angle liquid flow channel) of an electric thermal-conversion object are crooked as a configuration of a recording head is also included in this invention. In addition, it is good also as a configuration based on JP,59-138461,A which indicates the configuration whose opening which absorbs the pressure wave of JP,59-123670,A which indicates the configuration which uses a common slot as the discharge part of an electric thermal-conversion object to two or more electric thermal-conversion objects, or heat energy is made to correspond to a discharge part.

[0059] Furthermore, any of the configuration which fills the die length with the combination of two or more recording heads which are indicated by the specification mentioned above as a recording head of the full line type which has the die length corresponding to the width of face of the maximum record medium which can record a recording device, and the configuration as one recording head formed in one are sufficient.

[0060] In addition, the recording head of the exchangeable chip type with which the electric connection with the body of equipment and supply of the ink from the body of equipment are attained may be used by not only the recording head of the cartridge type with which the ink tank was formed in the recording head itself explained with the above-mentioned operation gestalt in one but the body of equipment being equipped.

[0061] Moreover, since record actuation is further made to stability, it is desirable to add the recovery means against a recording head, a preliminary means, etc. to the configuration of the recording device explained above. If these are mentioned concretely, there is a preheating means by the capping means, the cleaning means, the pressurization or the suction means, the electric

thermal-conversion object, the heating elements different from this, or such combination over a recording head etc. Moreover, it is effective in order to perform record stabilized by having the reserve regurgitation mode in which the regurgitation different from record is performed.

[0062] Furthermore, by constituting not only the recording mode of only mainstream colors, such as black, but a recording head in one as a recording mode of a recording device, even with two or more combination, although it is good, it can also consider as equipment equipped with full color at least one by the double color color of a different color, or color mixture.

[0063] In the gestalt of the operation explained above, although it is explaining as a premise that ink is a liquid Even if it is ink solidified less than [ a room temperature or it ], what is softened or liquefied at a room temperature may be used. Or by the ink jet method, since what carries out temperature control is common as a temperature control is performed for ink itself by within the limits below 70-degreeC more than 30-degreeC and it is in the stabilization regurgitation range about the viscosity of ink, ink should just make the shape of liquid at the time of use record signal grant.

[0064] In addition, in order to prevent positively by making the temperature up by heat energy use it positively as energy of the change of state from a solid condition to the liquid condition of ink, or in order to prevent evaporation of ink, the ink which solidifies in the state of neglect and is liquefied with heating may be used. Anyway, ink liquefies by grant according to the record signal of heat energy, and this invention can be applied also when using the ink of the property which will not be liquefied without grant of heat energy, such as that by which liquefied ink is breathed out, and a thing which it already begins to solidify when reaching a record medium. In such a case, ink is good for a porosity sheet crevice or a through tube which is indicated by JP,54-56847,A or JP,60-71260,A also as liquefied or a gestalt which counters to an electric thermal-conversion object in the condition of having been held as a solid. In this invention, the most effective thing performs the film-boiling method mentioned above to each ink mentioned above.

[0065] Furthermore, in addition, as a gestalt of the recording device concerning this invention, although prepared in one or another object as an image printing terminal of information management systems, such as a computer, the gestalt of the reproducing unit combined with others, a reader, etc. and the facsimile apparatus which has a transceiver function further may be taken.

[0066] In addition, even if it applies this invention to the system which consists of two or more devices (for example, a host computer, an interface device, a reader, a printer, etc.), it may be applied to the equipments (for example, a copying machine, facsimile apparatus, etc.) which consist of one device.

[0067] Moreover, it cannot be overemphasized by the purpose of this invention supplying the storage which recorded the program code of the software which realizes the function of the operation gestalt mentioned above to a system or equipment, and carrying out read-out activation of the program code with which the computer (or CPU and MPU) of the system or equipment was stored in the storage that it is attained.

[0068] In this case, the function of the operation gestalt which the program code itself read from the storage mentioned above will be realized, and the storage which memorized that program code will constitute this invention.

[0069] As a storage for supplying a program code, a floppy disk, a hard disk, an optical disk, a magneto-optic disk, CD-ROM, CD-R, a magnetic tape, the memory card of a non-volatile, ROM, etc. can be used, for example.

[0070] Moreover, it cannot be overemphasized that it is contained also when the function of the operation gestalt which performed a part or all of processing that OS (operating system) which is

working on a computer is actual, based on directions of the program code, and the function of the operation gestalt mentioned above by performing the program code which the computer read is not only realized, but was mentioned above by the processing is realized.

[0071] Furthermore, after the program code read from a storage is written in the memory with which the functional expansion unit connected to the functional add-in board inserted in the computer or a computer is equipped, it cannot be overemphasized that it is contained also when the function of the operation gestalt which performed a part or all of processing that CPU with which the functional add-in board and functional expansion unit are equipped based on directions of the program code is actual, and mentioned above by the processing is realized.

[0072]

[Effect of the Invention] Since the signal received electrode used when inputting a pulse signal and performing ink piece detection, and a magnification means amplify the signal received with the electrode are mounted on the same substrate according to this invention as explained above, the physical distance of the electrode and magnification means becomes short, and that a noise mixes in an input signal decreases and it becomes possible to perform more reliable ink piece detection.

[0073] Moreover, it can reduce the components mark which constitute equipment from mounting an electrode and a magnification means on the same substrate, and it not only can also prevent the trouble by poor contact, but contributes to improvement in the assembly nature at the time of equipment manufacture.

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## TECHNICAL FIELD

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[Field of the Invention] Especially this invention relates to the recording device equipped with the recording head which records the information on an alphabetic character, an image, etc. by carrying out the regurgitation of the ink on a record medium about a recording device.

[0002]

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## PRIOR ART

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[Description of the Prior Art] The recording device by the ink jet method has spread quickly as one of the output (record) equipment of those devices with the spread of information management systems, such as a reproducing unit in recent years, and a word processor, a computer.

[0003] Generally the ink jet recording device is equipped with the control means for controlling the carriage carrying the recording head and ink tank which carry out the regurgitation of the liquid ink drop, a conveyance means to convey a record medium, and these.

[0004] Now, in such an ink jet recording device, a liquid ink drop is not breathed out from a recording head with the ink piece of the ink tank in the middle of record actuation, but poor record may arise. For example, if an ink piece arises while recording many, feeding paper to a record form continuously, the chart lasting time after an ink piece will become useless.

Moreover, when the record indistinct in the state of the so-called "blur record" produced by the ability not carrying out the regurgitation of the liquid ink drop appropriately also just before an ink piece is continued, many record media may be made useless.

[0005] In order to avoid such fault, the ink piece detection approaches various until now are proposed. For example, the method of performing ink piece detection is proposed by inputting a known pulse signal into a recording head, and detecting the input pulse signal with the antenna electrode which adjoined the ink tank wall surface. Henceforth, this approach is called the "pulse

transfer ink piece detection approach."

[0006] Hereafter, with reference to drawing 9 and drawing 10, the principle of the pulse transfer ink piece detection approach is explained. In these drawings, the case where it is a time of drawing 10 not having ink in an ink tank in the case where it is a time of drawing 9 having ink in an ink tank is shown.

[0007] The electrode 102 which touches ink is formed in the interior of a recording head 101, and as shown in these drawings, in order to detect an ink piece, on the other hand, it connects in the ink passage 106 for a recording head 101 to supply ink, and the antenna electrode 107 is formed so that the wall surface of the ink tank 103 which held the sponge 104 for holding ink may be adjoined.

[0008] Moreover, as shown in drawing 9, when ink is in the ink tank 103, ink will fully be sunk in at sponge 104. On the other hand, as shown in drawing 10, when there is no ink in the ink tank 103, sponge 104 will not be in the condition of having been filled with ink any longer, but the space 111 without ink will come to produce it in the ink passage 106.

[0009] Now, in order to detect an ink piece, the known input pulse 105 is inputted into an electrode 102. This input pulse is spread on the ink tank 103 by using the ink in the ink passage 106 as an electric conduction medium. It is detected by the antenna electrode 107 which adjoined the ink tank wall surface, the sample of the peak (maximal value) and bottom (minimal value) of an output signal from an op amplifier 108 is carried out after magnification by the op amplifier 108 (AMP) in a sample hold circuit (S/H) 109, and the pulse which got across to the ink tank is inputted into the A/D port of CPU110. By CPU110, the amplitude of a signal is computed from this input signal, and the signal amplitude obtained as a result is compared with a predetermined criterion (threshold).

[0010] When ink is in the ink tank 103, as shown in drawing 9, the amplitude (p-p) of the output signal 112 from an op amplifier 108 is large, and the signal amplitude computed by CPU207 has a value beyond a criterion. Therefore, CPU110 is judged to be ink piece nothing, i.e., those with ink.

[0011] On the other hand, when there is no ink in an ink tank, the pulse signal 105 inputted into the electrode 102 is intercepted in the space 111 in the ink passage 106, and does not reach even to the ink tank 103. Consequently, a pulse signal is not detected from the antenna electrode 107 contiguous to the ink tank 103, but the amplitude (p-p) of the output signal 113 from an op amplifier 108 becomes very small. Therefore, the value of the signal amplitude computed by CPU207 is also very small, becomes below a criterion, and is judged as CPU207 having no ink piece, i.e., ink.

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## EFFECT OF THE INVENTION

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[Effect of the Invention] Since the signal received electrode used when inputting a pulse signal and performing ink piece detection, and a magnification means amplify the signal received with the electrode are mounted on the same substrate according to this invention as explained above, the physical distance of the electrode and magnification means becomes short, and that a noise mixes in an input signal decreases and it becomes possible to perform more reliable ink piece detection.

[0073] Moreover, it can reduce the components mark which constitute equipment from mounting an electrode and a magnification means on the same substrate, and it not only can also prevent the trouble by poor contact, but contributes to improvement in the assembly nature at the time of equipment manufacture.

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## TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention] However, in the above-mentioned conventional example, since the detail part by a sheet metal etc. was used for the antenna electrode, components mark increased as the whole equipment and there were troubles, like parts control and assembly nature are bad.

[0013] In addition, since it was carrying out by making connection of an electrical circuit to an antenna electrode for the screw stop of an antenna electrode and the circuit board conventionally, there was a problem of causing the fall of the dependability by the slack of a screw etc. Moreover, in the above-mentioned configuration, an antenna electrode, an electrical circuit required for ink piece detection, and the physical distance of a between became long, the S/N ratio got worse by mixing of an external noise, and there was a problem that malfunction of equipment occurred.

[0014] The ink piece detection which was made in view of the above-mentioned conventional example, and had high dependability is possible for this invention, and it is in offering the recording device which can incorporate a component required for the detection easily.

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## MEANS

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[Means for Solving the Problem] In order to attain the above-mentioned purpose, the recording device of this invention consists of the following configurations.

[0016] Namely, the recording head which is the recording device which records an image by carrying out the regurgitation of the liquid ink drop to a record medium, and prepared the 1st electrode, An ink tank and the 2nd electrode which adjoins the wall surface of said ink tank and is prepared, An input means to input the pulse signal of a predetermined frequency into said 1st electrode, It is based on the signal amplified by magnification means to amplify the signal received with said 2nd electrode, and said magnification means. It has a detection means to detect the ink piece of said ink tank, and has the recording device characterized by mounting said the 2nd electrode and said magnification means on the same substrate.

[0017] A magnification means is mounted in the 1st layer of said substrate, the 2nd electrode is mounted in the 2nd layer of the substrate as a pattern, and you may make it make the substrate adjoin the wall surface of an ink tank here so that the 2nd layer may become near by the wall surface of an ink tank.

[0018] Furthermore, you may make it prepare the shielding layer grounded as the 3rd layer between the 1st layer and the 2nd layer.

[0019] Moreover, you may make it said ink tank contain the 1st tank which holds cyanogen ink, the 2nd tank which holds Magenta ink, and the 3rd tank which holds Hierro ink. In this case, as for a recording head, it is desirable to have the 1st, the 2nd, and the 3rd head unit, and to prepare the 1st electrode in the 1st, 2nd, and 3rd head unit of each so that the regurgitation of cyanogen ink, Magenta ink, and the Hierro ink may be carried out.

[0020] Although it is the ink jet recording head which records by this recording head breathing out ink, in order to carry out the regurgitation of the ink using heat energy, as for that recording head, it is desirable to have the electric thermal-conversion object for generating the heat energy given to ink.

[0021]

[Embodiment of the Invention] With reference to an accompanying drawing, the suitable operation gestalt of this invention is explained to a detail below.

[0022] <Approximate account of body of equipment> drawing 1 is the appearance perspective

view showing the outline of the configuration of the ink jet printer IJRA which is the gestalt of typical operation of this invention. In drawing 1, the carriage HC engaged to the spiral slot 5004 of a leading screw 5005 which is interlocked with the forward inverse rotation of a drive motor 5013, and is rotated through the driving force transfer gears 5009-5011 has a pin (un-illustrating), is supported by the guide rail 5003, and carries out both-way migration of an arrow head a and the direction of b. The recording head IJH and the one apparatus ink jet cartridge IJC which built in the ink tank IT are carried in Carriage HC. 5002 is a paper bail plate and presses the record form P to a platen 5000 covering the migration direction of Carriage HC. 5007 and 5008 are photo couplers and are a home-position detector for checking existence [ in this region of the lever 5006 of carriage ], and performing a hand-of-cut switch of a motor 5013 etc. 5016 is the member which supports the cap member 5022 which caps the front face of a recording head IJH, and 5015 is the aspirator which attracts the inside of this cap, and performs suction recovery of a recording head through the opening 5023 in a cap. 5017 is a cleaning blade, 5019 is a member which makes this blade movable at a cross direction, and these are supported by the body support plate 5018. It cannot be overemphasized that not this gestalt but a well-known cleaning blade can apply a blade to this example. Moreover, 5021 is a lever for starting suction of suction recovery, it moves with migration of the cam 5020 which engages with carriage, and migration control is carried out by the transfer devices in which the driving force from a drive motor is well-known, such as a clutch switch.

[0023] When carriage comes to the field by the side of a home position, it is constituted so that a request can be processed according to an operation of a leading screw 5005 in those correspondence locations, but if it is made to operate to well-known timing about a request, each can apply these capping, cleaning, and suction recovery to this example.

[0024] The control configuration for performing <explanation of a control configuration>, next record control of equipment mentioned above is explained.

[0025] Drawing 2 is the block diagram showing the configuration of the control circuit of an ink jet printer IJRA. In this drawing showing a control circuit, ROM which stores the control program with which MPU performs the interface into which 1700 inputs a record signal, and 1701, and MPU1701 performs 1702, and 1703 are DRAMs which save various data (record data supplied to the above-mentioned record signal or a head). 1704 is a gate array (G. A.) which performs supply control of the record data to a recording head 1708, and also performs data transfer control between an interface 1700, and MPU1701 and RAM1703. A carrier motor for 1710 to convey a recording head 1708 and 1709 are the conveyance motors for recording paper conveyance. The head driver to which 1705 drives a recording head, and 1706 and 1707 are Motor Driver for driving the conveyance motor 1709 and the carrier motor 1710, respectively.

[0026] If actuation of the above-mentioned control configuration is explained, and a record signal goes into an interface 1700, a record signal will be changed into the record data for a print between a gate array 1704 and MPU1701. And while Motor Driver 1706 and 1707 drives, a recording head drives according to the record data sent to the head driver 1705, and record is performed.

[0027] In addition, the ink jet cartridge IJC in this operation gestalt shall carry two or more ink tanks for color record.

[0028] Next, the ink piece detection according to this operation gestalt is explained. Here, in order to explain the description and effectiveness of this operation gestalt more clearly, it explains as compared with the configuration and its processing of the circuit used for the conventional ink piece detection.

[0029] First, conventional circuitry and its processing are explained.

[0030] Drawing 3 is drawing showing the structure of the ink jet cartridge IJC, the configurations

of the conventional antenna electrode, and such physical relationship.

[0031] It consists of recording heads IJH equipped with three head units which offered the ink delivery which corresponded in order to carry out the regurgitation of the ink of each color supplied from ink tank IT-c in which the ink jet cartridge IJC holds cyanogen (C) ink as shown in drawing 3, ink tank IT-m which holds Magenta (M) ink, ink tank IT-y which holds Hierro (Y) ink, and these ink tanks. Moreover, the electrode (un-illustrating) is prepared in the recording head IJH so that the electrical and electric equipment may get across to each ink tank through the ink of ink passage (un-illustrating). On the other hand, to the field where all of the wall surface of these ink tanks have appeared, as shown in drawing 3, the antenna electrode 402 is arranged. And the stop of the circuit board 405 which mounted the op amplifier (AMP) 406 so that the antenna electrode 402 might be countered is \*\*\*\*ed and carried out to the metal plate which constitutes the antenna electrode 402 with a screw 409.

[0032] Now, in order to detect the ink piece in these ink tank, the pulse signal will use ink as an electric conduction medium, and MPU1701 will be transmitted even to an ink tank, if the pulse signal of a predetermined frequency is inputted into a recording head IJH as a record signal through the above-mentioned electrode. The signal with which even the ink tank reached is transmitted from an ink tank wall surface to the antenna electrode 402.

[0033] Drawing 4 is drawing showing the configuration of the equalizing circuit of the circuit relevant to ink piece detection, and the conventional ink piece detector among configurations of being shown in drawing 3.

[0034] That is, the pulse signal of a predetermined frequency is inputted one by one, changing a switch 413 to three head section electrode 401 each prepared corresponding to three ink tanks. Thus, the pulse signal 407 inputted from the head section electrode 401 prepared in the recording head IJH is transmitted to the ink tank wall surface 404 by using ink 403 as an electric conduction medium. The signal transmitted to the ink tank wall surface 404 is transmitted to the antenna electrode 402 which adjoins an ink tank wall surface by a kind of capacity coupling.

[0035] As shown in drawing 3, it is fixed with a screw 409, and the antenna electrode 402 and the circuit board 405 are electrically connected in the contact section, as shown in drawing 4. Therefore, the signal from the antenna electrode 402 is inputted and amplified by the substrate 405 from the contact section at propagation and an op amplifier (AMP) 406. And as the conventional example also explained, sample hold of the signal 408 outputted from the op amplifier (AMP) 406 is carried out, and further, A/D conversion of it is carried out, it turns into a digital signal, and is inputted into MPU1701. And this digital signal is compared with the criterion (threshold) stored in ROM1702, and the existence of an ink piece is detected.

[0036] In addition, it connects with the circuit board in the place which left the output from an antenna electrode with wiring, without carrying out the screw stop of the antenna electrode 402 and the circuit board 405 conventionally, and there are some which were constituted so that it might input into the op amplifier (AMP) mounted on the circuit board.

[0037] Next, the circuit board for the antenna electrode according to this operation gestalt and ink piece detection is explained.

[0038] Drawing 5 is drawing showing the structure of the ink jet cartridge IJC, the configurations of the antenna electrode according to this operation gestalt, and such physical relationship. In addition, in drawing 5, the reference number same about the same component as having already explained in drawing 3 is attached, and the explanation is omitted.

[0039] As shown in drawing 5, the circuit board 603 is arranged to ink tank IT-c, IT-m, and the field where all the wall surfaces of IT-y have appeared. And on the circuit board 603, the pattern 604 and op amplifier (AMP) 406 for antenna electrodes are mounted.

[0040] Drawing 6 is drawing showing the configuration of the equalizing circuit of the circuit



relevant to ink piece detection, and the conventional ink piece detector among configurations of being shown in drawing 5 . In addition, in drawing 6 , the reference number same about the same component as having already explained in drawing 4 is attached, and the explanation is omitted. [0041] That is, the pulse signal of a predetermined frequency is inputted one by one, changing a switch 413 to three head section electrode 401 each prepared corresponding to three ink tanks. Thus, the pulse signal 407 inputted from the head section electrode 401 is transmitted to the pattern 604 for antenna electrodes prepared on the circuit board 603 which adjoins an ink tank wall surface as mentioned above by a kind of capacity coupling. Thus, the signal which got across to the pattern 604 for antenna electrodes is inputted into the op amplifier (AMP) 406 similarly mounted in the circuit board 603. And as the conventional example also explained, sample hold of the output signal 408 amplified by the op amplifier (AMP) 107 is carried out, and further, A/D conversion of it is carried out, it turns into a digital signal, and is inputted into MPU1701. And this digital signal is compared with the criterion (threshold) stored in ROM1702, and the existence of an ink piece is detected.

[0042] Here, the ink piece detection processing performed based on the above configuration is explained with reference to the flow chart shown in drawing 7 . With this operation gestalt, when an ink jet printer IJRA goes into a recording mode, existence of an ink piece is checked.

[0043] That is, at step S110, if it becomes a recording mode, as mentioned above, the pulse 407 of a predetermined frequency will be inputted into the electrode 401 prepared in the recording head IJH, and the detecting signal from the antenna electrode 604 will be acquired. At step S120, it investigates whether the ink piece is generated based on the detecting signal.

[0044] Here, when it is judged that the ink piece is generated (with no ink), processing progresses to step S130 and performs suction recovery action. in addition, since there is no ink piece detection by pulse transfer by the approach of detecting the ink residue in an ink tank, at step S140, there is no ink into an ink tank by this suction recovery action -- or it checks again by inputting a pulse into the electrode of a recording head for whether ink only went out to ink passage, and acquiring the detecting signal from an antenna electrode. If ink only went out to ink passage, by suction recovery action, cutting of ink passage is recovered and it should be judged with there being no ink piece.

[0045] Here, when again judged as an ink piece, processing progresses to step S150, makes the ink exchange lamp formed in the control panel (un-illustrating) of an ink jet printer IJRA turn on, and demands ink tank exchange from a user. Furthermore, the ink tank exchange by the user is checked at step S160. That is, in step S160, if exchange of an ink tank is not checked, processing returns to step S150, lighting of an ink exchange lamp is continued and exchange of an ink tank is checked, processing will return to step S110 and will perform ink piece detection again.

[0046] Moreover, in step S140, if generating of an ink piece is not checked, processing progresses to step S170 and starts record actuation.

[0047] Also in step S120, if generating of an ink piece is not checked, processing progresses to step S170 and starts record actuation further again.

[0048] In the pulse transfer ink piece detection explained above, the signal outputted from the antenna electrode 604 is a very minute signal. For this reason, the S/N ratio of a signal gets worse extremely by noise mixing from the outside, and malfunction may be caused.

[0049] However, with the operation gestalt explained above, since the antenna electrode and the op amplifier (AMP) are mounted on the same substrate, it is possible to shorten physical distance between an antenna electrode and an op amplifier (AMP), and extreme aggravation of the S/N ratio by noise mixing from the outside can be prevented. Moreover, since it is not necessary to connect with wiring the circuit board which mounted the antenna electrode and the op amplifier like before since the antenna electrode was on the circuit board, it is also possible to prevent the



trouble by poor contact, and it becomes possible to secure high dependability to ink piece detection.

[0050] Furthermore, the components mark of the whole equipment lead also to reduction, and that such a connection is lost or mounting an antenna electrode and an op amplifier (AMP) on the same substrate contribute also to improvement in the assembly nature at the time of equipment manufacture.

[0051] Although the above-mentioned operation gestalt explained the example which prepared the op amplifier (AMP) and the pattern for antenna electrodes on the same side of the circuit board which adjoined the ink tank, as shown in drawing 8, the structure of the circuit board 603 may be the multilayer substrate which consists of a components layer (field) 801 which mounts an op amplifier 406, and an antenna electrode layer 802 which prepared the pattern for antenna electrodes. And as for a patterned layer, it is desirable to make it become a field nearest to an ink tank. Thus, in the constituted circuit board, the signal received by the pattern for antenna electrodes prepared in the antenna electrode layer 802 is inputted into the op amplifier (AMP) 406 mounted by the components layer 801 on propagation and the components layer 801 from the antenna electrode layer 802 by the through hole.

[0052] This input signal is processed as mentioned above, and the existence of an ink piece is detected.

[0053] In addition, the circuit board may be made into the multilayer structure of three or more layers, and you may make it the configuration which has a components layer (field), an antenna electrode layer, and a shielding layer. In this case, the layer nearest to an ink tank arranges the pattern grounded by the layer which adjoins an antenna electrode layer and this antenna electrode layer, makes this a shielding layer, and uses the remaining layers as a components layer. By making it such a configuration, the electric noise and external noise which are generated from the electrical part mounted on the components layer (field) can prevent aggravation of the S/N ratio of the detection signal received by the antenna electrode with propagation and an antenna electrode.

[0054] In addition, in the above operation gestalt, although it was explained that the drop breathed out from a recording head was ink, and it was explained that the liquid further held in an ink tank was ink, the hold object is not limited to ink. For example, in order to raise fixable and the water resisting property of a record image or to raise the image quality, a thing like the processing liquid breathed out to a record medium may be held in the ink tank.

[0055] Especially the above operation gestalt is equipped with means (for example, an electric thermal-conversion object, a laser beam, etc.) to generate heat energy as energy used also in an ink jet recording method in order to make the ink regurgitation perform, and can attain the densification of record, and highly minute-ization by using the method which makes the change of state of ink occur with said heat energy.

[0056] About the typical configuration and typical principle, what is performed using the fundamental principle currently indicated by the U.S. Pat. No. 4723129 specification and the 4740796 specification, for example is desirable. Although this method is applicable to both the so-called mold on demand and a continuous system On the electric thermal-conversion object which is especially arranged corresponding to the sheet and liquid route where the liquid (ink) is held in the case of the mold on demand By impressing at least one driving signal which gives the rapid temperature rise which supports recording information and exceeds film boiling Since make an electric thermal-conversion object generate heat energy, the heat operating surface of a recording head is made to produce film boiling and the air bubbles in the liquid (ink) corresponding to this driving signal can be formed by 1 to 1 as a result, it is effective. A liquid (ink) is made to breathe out through opening for regurgitation by growth of these air bubbles,

and contraction, and at least one drop is formed. If the shape of a pulse form is carried out, since growth contraction of air bubbles will be appropriately performed instantly in this driving signal, the regurgitation of a liquid (ink) excellent in especially responsibility can be attained, and it is more desirable.

[0057] As a driving signal of the shape of this pulse form, what is indicated by the U.S. Pat. No. 4463359 specification and the 4345262 specification is suitable. In addition, if the conditions indicated by the U.S. Pat. No. 4313124 specification of invention about the rate of a temperature rise of the above-mentioned heat operating surface are adopted, further excellent record can be performed.

[0058] The configuration using the U.S. Pat. No. 4558333 specification and U.S. Pat. No. 4459600 specification which indicate the configuration arranged to the field to which a delivery which is indicated by each above-mentioned specification, a liquid route, and the heat operating surface other than the combination configuration (a straight-line-like liquid flow channel or right-angle liquid flow channel) of an electric thermal-conversion object are crooked as a configuration of a recording head is also included in this invention. In addition, it is good also as a configuration based on JP,59-138461,A which indicates the configuration whose opening which absorbs the pressure wave of JP,59-123670,A which indicates the configuration which uses a common slot as the discharge part of an electric thermal-conversion object to two or more electric thermal-conversion objects, or heat energy is made to correspond to a discharge part.

[0059] Furthermore, any of the configuration which fills the die length with the combination of two or more recording heads which are indicated by the specification mentioned above as a recording head of the full line type which has the die length corresponding to the width of face of the maximum record medium which can record a recording device, and the configuration as one recording head formed in one are sufficient.

[0060] In addition, the recording head of the exchangeable chip type with which the electric connection with the body of equipment and supply of the ink from the body of equipment are attained may be used by not only the recording head of the cartridge type with which the ink tank was formed in the recording head itself explained with the above-mentioned operation gestalt in one but the body of equipment being equipped.

[0061] Moreover, since record actuation is further made to stability, it is desirable to add the recovery means against a recording head, a preliminary means, etc. to the configuration of the recording device explained above. If these are mentioned concretely, there is a preheating means by the capping means, the cleaning means, the pressurization or the suction means, the electric thermal-conversion object, the heating elements different from this, or such combination over a recording head etc. Moreover, it is effective in order to perform record stabilized by having the reserve regurgitation mode in which the regurgitation different from record is performed.

[0062] Furthermore, by constituting not only the recording mode of only mainstream colors, such as black, but a recording head in one as a recording mode of a recording device, even with two or more combination, although it is good, it can also consider as equipment equipped with full color at least one by the double color color of a different color, or color mixture.

[0063] In the gestalt of the operation explained above, although it is explaining as a premise that ink is a liquid Even if it is ink solidified less than [ a room temperature or it ], what is softened or liquefied at a room temperature may be used. Or by the ink jet method, since what carries out temperature control is common as a temperature control is performed for ink itself by within the limits below 70-degreeC more than 30-degreeC and it is in the stabilization regurgitation range about the viscosity of ink, ink should just make the shape of liquid at the time of use record signal grant.

[0064] In addition, in order to prevent positively by making the temperature up by heat energy

use it positively as energy of the change of state from a solid condition to the liquid condition of ink, or in order to prevent evaporation of ink, the ink which solidifies in the state of neglect and is liquefied with heating may be used. Anyway, ink liquefies by grant according to the record signal of heat energy, and this invention can be applied also when using the ink of the property which will not be liquefied without grant of heat energy, such as that by which liquefied ink is breathed out, and a thing which it already begins to solidify when reaching a record medium. In such a case, ink is good for a porosity sheet crevice or a through tube which is indicated by JP,54-56847,A or JP,60-71260,A also as liquefied or a gestalt which counters to an electric thermal-conversion object in the condition of having been held as a solid. In this invention, the most effective thing performs the film-boiling method mentioned above to each ink mentioned above.

[0065] Furthermore, in addition, as a gestalt of the recording device concerning this invention, although prepared in one or another object as an image printing terminal of information management systems, such as a computer, the gestalt of the reproducing unit combined with others, a reader, etc. and the facsimile apparatus which has a transceiver function further may be taken.

[0066] In addition, even if it applies this invention to the system which consists of two or more devices (for example, a host computer, an interface device, a reader, a printer, etc.), it may be applied to the equipments (for example, a copying machine, facsimile apparatus, etc.) which consist of one device.

[0067] Moreover, it cannot be overemphasized by the purpose of this invention supplying the storage which recorded the program code of the software which realizes the function of the operation gestalt mentioned above to a system or equipment, and carrying out read-out activation of the program code with which the computer (or CPU and MPU) of the system or equipment was stored in the storage that it is attained.

[0068] In this case, the function of the operation gestalt which the program code itself read from the storage mentioned above will be realized, and the storage which memorized that program code will constitute this invention.

[0069] As a storage for supplying a program code, a floppy disk, a hard disk, an optical disk, a magneto-optic disk, CD-ROM, CD-R, a magnetic tape, the memory card of a non-volatile, ROM, etc. can be used, for example.

[0070] Moreover, it cannot be overemphasized that it is contained also when the function of the operation gestalt which performed a part or all of processing that OS (operating system) which is working on a computer is actual, based on directions of the program code, and the function of the operation gestalt mentioned above by performing the program code which the computer read is not only realized, but was mentioned above by the processing is realized.

[0071] Furthermore, after the program code read from a storage is written in the memory with which the functional expansion unit connected to the functional add-in board inserted in the computer or a computer is equipped, it cannot be overemphasized that it is contained also when the function of the operation gestalt which performed a part or all of processing that CPU with which the functional add-in board and functional expansion unit are equipped based on directions of the program code is actual, and mentioned above by the processing is realized.

## DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the appearance perspective view showing the outline of the configuration of the ink jet printer IJRA which is the gestalt of typical operation of this invention.

[Drawing 2] It is the block diagram showing the configuration of the control circuit of an ink jet printer IJRA.

[Drawing 3] It is drawing showing the structure of the ink jet cartridge IJC, the configurations of the conventional antenna electrode, and such physical relationship.

[Drawing 4] It is drawing showing the configuration of the equalizing circuit of the circuit relevant to ink piece detection, and the conventional ink piece detector among configurations of being shown in drawing 3 .

[Drawing 5] It is drawing showing the structure of the ink jet cartridge IJC, the configurations of the antenna electrode according to this operation gestalt, and such physical relationship.

[Drawing 6] It is drawing showing the configuration of the equalizing circuit of the circuit relevant to ink piece detection, and the conventional ink piece detector among configurations of being shown in drawing 5 .

[Drawing 7] It is the flow chart which shows ink piece detection processing.

[Drawing 8] It is drawing showing the structure of the ink jet cartridge IJC, the configurations of the antenna electrode according to other operation gestalten, and such physical relationship.

[Drawing 9] It is drawing explaining the principle of the pulse transfer ink piece detection approach in the case of being a time of ink being in an ink tank.

[Drawing 10] It is drawing explaining the principle of the pulse transfer ink piece detection approach in the case of being a time of there being no ink in an ink tank.

[Description of Notations]

IJC Ink jet cartridge

IJH Recording head

IT and IT-c, IT-m, IT-y Ink tank

401 Head Section Electrode

402 Antenna Electrode

403 Ink

404 Ink Tank Wall Surface

405 Circuit Board

406 Op Amplifier (AMP)

407 Input Pulse

408 Output Signal

409 Screw

410 Switch

603 Circuit Board

604 Pattern for Antenna Electrodes

1701 MPU

1702 ROM

1703 DRAM

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[Translation done.]